Show A002145 primes of form $4K+3$ 1/2

can be derived via $\text{bitor}(m, m+2)$, m odd

Every odd $\# > 1$ is expressible as

power of 2 + an odd #, power ≥ 1

Examples

decimal	binary	equivalence
33	100001	$2^5+1 = 4(8)+1$
35	100011	$2^5+3 = 4(8)+3$
37	100101	$2^5+5 = 4(9)+1$
39	100111	$2^5+7 = 4(9)+3$
41	101001	$2^5+9 = 4(10)+1$
etc.		etc

All of the forms are $\{1,3\}$ mod 4, alternating.

Thus, with consecutive odds we have

$$\begin{array}{rr} & xxxx01 \\ (\text{OR}) & xxxx11 \\ \hline & xxxx11 \end{array}$$

The result is clearly $3 \bmod 4 \triangleq 4K+3$

→

2/2

When we form $m+2$, it could rollover to the next power of 2 (ie $15 = 2^3+7$, $17 = 2^4+1$)

This is the case

$$\begin{array}{lr} & 111\ldots111 \quad (m) \\ (\text{OR}) & 1000\ldots001 \quad (m+2) \\ \hline & 1111\ldots111 \quad (1) \end{array}$$

$(1) = 2^j - 1$ = 1 less than a power of 2

is $(2^j-1) \overset{?}{\triangleq} 4k+3$? $\left(\begin{array}{l} j \geq 2 \\ k \geq 0 \end{array}\right)$

Rewrite as:

$$2^j - 2^2 + (2^2-1) \overset{?}{\triangleq} 2^2 k + 3$$

$$2^j - 2^2 + \cancel{3} \overset{?}{\triangleq} 2^2 k + \cancel{3}$$

$$2^j \overset{?}{\triangleq} 2^2(k+1)$$

$$2^{(j-2)} \overset{?}{\triangleq} k+1$$

Yes, always soln in N

1/1

show A002144 primes of form 4K+1

From earlier A2145 proof, it deviates at

$$\begin{array}{r} \text{xxxx01} \\ \text{(AND)}\ \underline{\text{xxxx11}} \\ \text{xxxx01} \end{array} \qquad (1)$$

The Result is clearly 1 mod 4 $\triangleq$ 4K+1

From earlier A2145 page 2 proof, we see:

$$\begin{array}{rl} 111\ldots111 & (n) \\ \text{(AND)}\ \underline{1001\ldots1001} & (n+2) \\ 1000\ldots001 & \end{array}$$

power of 2 plus 1

This mimics (1) above

From A2145, $2^{j}+1 \overset{?}{\triangleq} 4K+1 \qquad (K \geq 1, j \geq 2)$

$$\frac{2^{j}}{2^{2}} \overset{?}{\triangleq} K$$

Yes, always soln in $\mathbb{N}$

show A033200 primes $\triangleq \{1,3\}$ mod 8

$\frac{B_n}{11/1}$

It follows the earlier A003628 proof, it deviates

at:

	CASE A	CASE B
	xxx001	xxx011
(AND)	xxx101	xxx111
	xxx001	xxx011

(1)

(1) forms possible are 1 mod 8, 7 mod 8 only

Show A003628 primes $\triangleq \{5,7\} \bmod 8$

can be derived via bitor$(m,m+4)$, m odd

Per the A002145 proof, we have consecutive odds examples

decimal	equivalence
33	$8(4)+1$
35	$8(4)+3$
37	$8(4)+5$
39	$8(4)+7$
41	$8(5)+1$
etc	etc

So the forms are $\{1,3,5,7\} \bmod 8$

Considering m, $(m+4)$ recognizing the pairs differ by $4 \bmod 8$,

	CASE A	CASE B
	xxx001	xxx011
(OR)	xxx101	xxx111
	101	xxx111

(1)

(1) forms possible are $5 \bmod 8$, $7 \bmod 8$ only